

FORM PTO-1390
REV. 5-93US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICEATTORNEYS DOCKET NUMBER
P99,2405**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/445112

INTERNATIONAL APPLICATION NO.

PCT/DE98/01449

INTERNATIONAL FILING DATE

27 May 1998

PRIORITY DATE CLAIMED

03 June 1997

TITLE OF INVENTION

"METHOD AND ARRANGEMENT FOR REDUCING THE PUMP LIGHT AT THE EXIT OF A FIBER LASER"

APPLICANT(S) FOR DO/EO/US

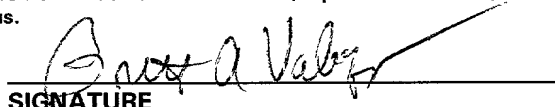
Heinrich Jügensen

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **Unexecuted**
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (**PTO 1449, Prior Art, Search Report**).
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
(SEE ATTACHED ENVELOPE)
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
 - a. ☒ Submission of Drawings - one sheet - **Submission of Corrected Drawings**
 - b. ☒ **EXPRESS MAIL #EL428568075US dated December 2, 1999.**

| | | | | | |
|--|--------------|--|--|---|----|
| U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/445112 | | INTERNATIONAL APPLICATION NO. PCT/DE98/01449 | | ATTORNEY'S DOCKET NUMBER P99,2405 | |
| BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO \$840.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. \$670.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) \$760.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO \$970.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$ 96.00 ENTER APPROPRIATE BASIC FEE AMOUNT = | | | | \$840.00 | |
| Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)). | | | | \$ 0 | |
| | | | | | |
| Claims | Number Filed | Number Extra | Rate | | |
| Total Claims | 8 - 20 = | 0 | X \$ 18.00 | \$0 | |
| Independent Claims | 2 - 3 = | 0 | X \$ 78.00 | \$0 | |
| Multiple Dependent Claims | | | \$260.00 + | \$ | |
| TOTAL OF ABOVE CALCULATIONS = | | | | \$ 840.00 | |
| Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28) | | | | \$ | |
| SUBTOTAL = | | | | \$ | |
| Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)). | | | | \$ | |
| TOTAL NATIONAL FEE = | | | | \$ 840.00 | |
| Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property | | | | \$ | |
| TOTAL FEES ENCLOSED = | | | | \$ 840.00 | |
| | | | | Amount to be refunded | \$ |
| | | | | charged | \$ |
| <p>a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>840.00</u> to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>08-2290</u>. A duplicate copy of this sheet is enclosed.</p> <p>NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p> | | | | | |
| SEND ALL CORRESPONDENCE TO: Hill & Simpson A Professional Corporation 85th Floor Sears Tower Chicago, Illinois 60606 | | |  SIGNATURE <u>Brett A. Valiquet</u> NAME <u>27,841</u> Registration Number | | |

-1-

BOX PCT
IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

5

PRELIMINARY AMENDMENT

APPLICANTS: **HEINRICH JÜRGENSEN**

DOCKET NO: P99,2405

SERIAL NO:

GROUP ART UNIT:

EXAMINER:

10

INTERNATIONAL APPLICATION NO: PCT/DE98/01449

INTERNATIONAL FILING DATE: 27 May 1998

INVENTION: **"METHOD AND ARRANGEMENT FOR REDUCING THE
PUMP LIGHT AT THE EXIT OF A FIBER LASER"**

Assistant Commissioner for Patents,

15

Washington, D.C. 20231

Sir:

As a Preliminary Amendment for entry into the
National Stage for the above-identified PCT application,
the following is submitted:

20

IN THE DRAWINGS:

Please make the drawing corrections indicated in
the attached Submission of Corrected Drawings.

IN THE ABSTRACT:

Please amend the Abstract as follows:

25

In line 1, delete "ABSTRACT" and substitute

--ABSTRACT OF THE DISCLOSURE--.

In line 2, delete "The" and substitute --A--.

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In line 2, delete "cladding" and substitute
--sheath--.

In line 2, delete "the" and substitute --a--.

In line 5, delete "vagrant" and substitute
5 --stray--.

In line 7, delete "cladding" and substitute
--sheath--.

IN THE SPECIFICATION:

Please amend the specification as follows:

10 On page 1, delete "SPECIFICATION".

On page 1, before the title, insert

--S P E C I F I C A T I O N

TITLE--;

after the title, as a separate line, insert

15 **--BACKGROUND OF THE INVENTION--.**

On page 1, at line 1, insert --,-- after "core".

On page 1, at line 11, delete "cladding" and
substitute --sheath--.

On page 1, at line 22, delete "To that end" and
20 substitute --For that purpose--.

On page 1, at line 31, delete "appertaining" and
substitute --corresponding--.

On page 2, at line 17, delete "maladjustment" and
substitute --mis-adjustment--.

25 On page 2, before line 18 as a separate line,
insert the following heading:

--SUMMARY OF THE INVENTION--.

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On page 2, delete lines 23-25 and substitute the following:

--According to the invention, a method is provided for reducing pump light in an exit of a fiber laser formed of a fiber core surrounded by an inner fiber portion which in turn is surrounded by a sheath. A last section of the fiber laser preceding a light exit for laser light thereof does not have provided thereat at least a portion of the sheath.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the fiber laser of the invention in which pump light has been reduced in an exit thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

On page 2, at line 26, delete "The Figure" and substitute --Figure 1--.

On page 2, at line 27, after "light" insert --5--.

On page 2, at line 27, after "optics" insert --6--.

On page 2, rewrite line 28 to read: --at one end 4 of the fiber 10, the left end in the drawing. Let the pump fiber have a fiber core 2 surrounded by an inner fiber portion 1 and--.

On page 2, at line 29, before "diameter" insert --a--, after "diameter" insert -- d_k --, delete "70" and substitute --7--, delete "and" and substitute --an--, after "diameter" second occurrence, insert -- d_i --, delete "approximate" and substitute --approximately--.

On page 2, at line 30, after "diameter" insert -- d_o --.

On page 2, last line, after "rays" insert --8--, after "arrows" insert --at end face 9--, delete "Inventively" and substitute --According to the invention,--, after "fiber" insert --10--.

5 On page 3, at line 1, delete "cladding" and substitute --sheath 3--, after "section" insert --A--.

On page 3, at line 3, delete "cladding" and substitute --sheath--.

10 On page 3, at line 4, after "tapers" insert --at section B--.

On page 3, at line 7, after "fiber" insert --10--.

On page 3, at line 8, after "sheath" insert --7--.

15 On page 3, at line 11, delete "vagrant" and substitute --stray--.

On page 3, at line 12, after "core" insert --2--.

On page 3, at line 12, after "exit" insert --11 at end face 9--.

20 On page 3, at line 13, delete "cladding" and substitute --sheath--.

On page 3, at line 15, after "end" insert --or exit--.

On page 3, at line 15, delete "fiber end" and substitute --"fiber end"--.

25 On page 3, at line 16, delete "ensue" and substitute --occur--.

On page 3, as the last paragraph, insert the following paragraph:

30 --Although various minor changes and modifications might be proposed by those skilled in the art, it will be

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understood that my wish is to include within the claims of the patent warranted hereon all such changes and modifications as reasonably come within my contribution to the art.--

5 **IN THE CLAIMS:**

On page 4 of the claims, at line 1, please change "PATENT CLAIMS" to -- **I CLAIM AS MY INVENTION**--.

Please cancel claims 1-8 without prejudice

Please add new claims 9-16 as follows:

10 9. A method for reducing pump light in an exit of a fiber laser formed of a fiber core surrounded by an inner fiber portion which in turn is surrounded by a sheath, comprising the steps of:

15 providing a last section of the fiber laser preceding a light exit for laser light thereof so that at least a portion of the sheath is not provided.

10. The method according to claim 9 including the step of at least partially stripping said last section of said fiber laser of said sheath.

20 11. The method according to claim 10 wherein the sheath is entirely stripped away at said last section.

25 12. The method according to claim 9 wherein during manufacture said last section of said fiber laser has only at least a part of a sheath provided thereon.

13. The method according to claim 12 wherein during manufacture said last section has no sheath provided thereon at all.

14. The method according to claim 9 including the step of providing said sheath such that a diameter thereof tapers in wedge-like fashion toward said light exit in a region of said last section.

15. The method according to claim 9 including the step of removing at least the portion of said sheath at said last section by etching.

16. A fiber laser, comprising:
a fiber core surrounded by an inner fiber portion which in turn is surrounded by an outer sheath; and
at a last section of the fiber laser leading to a light exit for laser light said sheath being at least partially removed.

17. The fiber laser according to claim 16 wherein the sheath at said last section is entirely removed.

18. The fiber laser according to claim 16 wherein at a region of said last section said sheath tapers in wedge-like fashion toward said light exit.

19. The fiber laser according to claim 16 wherein at said last section said sheath is removed

completely and an outer portion of said inner fiber portion is roughened where said sheath is completely removed leading to said laser light exit.

20. A method for reducing pump light in an exit of a fiber laser formed of a fiber system surrounded by a sheath, comprising the steps of:


providing a last section of the fiber laser preceding a light exit for laser light thereof so that at least a portion of the sheath is not provided thereat.

REMARKS

The specification, drawings, and Abstract have been amended in accordance with U. S. practice. Also, new claims generally corresponding to claims prosecuted in the PCT prosecution are presented and which are drawn in accordance with U. S. practice.

A copy of an Information Disclosure Statement is also provided for the Examiner's review.

Respectfully submitted,



(Reg.No. 27,841)
Brett A. Valiquet
Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606
(312) 876-0200; Ext. 3844
Attorneys for Applicant

09/445112

514 Rec'd PCT/PTO 02 DEC 1999

Heidelberg GmbH
New PCT application
Our Case P-99,2405
97/92 PCT US
Inventor: Juergensen

Translation / November 18, 1999 / 911:849 /1312 words

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SPECIFICATION**METHOD AND ARRANGEMENT FOR REDUCING THE PUMP LIGHT AT THE EXIT OF A FIBER LASER**

5 In a fiber laser, the resonator is composed of a specific fiber that contains a single mode fiber in the inside core this being matched in terms of dimensions and material to the wave length range of the laser to be achieved and the diameter thereof lying in the region of a few μm . This "laser fiber" is surrounded by a "pump fiber" having a diameter of a few hundred μm into which the pump light is coupled. The "laser fiber" is thus embedded into the core of the pump fiber. The pump fiber is surrounded by a cladding of material having a different refractive index that guarantees the guidance of the pump light in the pump fiber, as known from light waveguide technology. The core of the pump fiber can have a round cross-section but can also have a cross-section deviating therefrom, for example rectangular or quadratic, in order to enable an especially good matching to the pump source (laser diode).

10 The pump mechanism occurs in that the pump light excites the laser fiber. As a result thereof, the pump energy is consumed more and more over the length of the fiber, namely, beginning at the pump source, the energy content of the pump fiber drops roughly exponentially up to the end, i.e. to the laser exit. Optical efficiencies of above 50% are achieved with fiber lasers. To that end, fiber lengths of approximately 50 meters are required. Up to 90% of the pump light has been consumed by the end of the fiber. Due to the exponential consumption of the pump power, it is not meaningful for economical reasons to make the pump fiber even longer, i.e. approximately 10% of the pump light emerges from the pump fiber and is superimposed on the laser light from the inner core of the fiber; the laser light thereby emerges from the fiber as a thin, diffraction-limited bundle, whereas the pump light has a very large aperture angle.

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30 The wave length of the pump source of a known fiber laser lies at 900 nm; the wave length of the appertaining laser lies at 1100 nm. The pump

power of this laser amounts to 20 W; the laser power amounts to approximately 10 W. Approximately 2 W pump power are superimposed on the laser light.

Given applications that attach importance to a precise laser power on the order of magnitude of 1%, as is generally required, for example, in reprographics, the presence of the pump light leads to considerable problems, since it does not follow the beam path of the laser light because of the different aperture. Substantial measuring errors in the sensors thus occur due to stray light that the pump light causes. Likewise, inadmissible heating by the pump light occurs in sensitive arrangements.

Although the pump light could be separated from the laser light by a steep edge filter, the filters are easily destroyed given high power densities. This leads to a spatially large structure and expensive filters. It would likewise be conceivable to intercept the pump light with suitable diaphragms. The problem with this is that either the diaphragms must be made so large that they also allow pump light to pass or there is the risk that the diaphragms burn given slight maladjustment.

An object of the invention is to find a simple method and a simple arrangement with which the remaining pump light is not even allowed to come to the end of the fiber but is already completely intercepted earlier, so that a reduction of the emerging pump light by at least the factor of 100 is achieved.

This object is achieved by the measures recited in claim 1. Advantageous developments of the invention are described in subclaims 2 through 8. The invention is described below with reference to the Figure.

The Figure shows a pump fiber that is shown in two cut sections for drafting-oriented reasons. The pump light is supplied via a focusing optics at one end of the fiber, the left end in the drawing. Let the fiber have a core diameter of approximately 70 μm , and inside diameter of approximate 300 μm and an outside diameter of approximately 600 μm . The pump light is guided by total reflection at the inside wall of the waveguide, this being illustrated with light rays provided with arrows. Inventively, the pump fiber is

stripped of its cladding over the last section, i.e. in the right-hand part of the drawing (for example, over the last 50 cm). This can occur by etching off the coating. The cladding is preferably etched off wedge-shaped, so that it tapers over, for example 40 cm beginning at the end facing toward the pump source and is then completely removed for a further 10 cm. As a result thereof, the remaining pump power of approximate 2 W is continuously eliminated into the environment over the distance of 40 cm. The pump fiber is usually surrounded by a protective sheath of tensile material, for example Kevlar fibers, that is in turn surrounded by a metal sheath. The heat transfer into the protective sheath can thus be controlled over the length of the wedge-shaped distance, so that no overheating occurs. How much vagrant pump light still proceeds via the fiber core to the fiber exit can be checked over the length of the fiber completely freed from the protective cladding. A length of 10 cm is completely adequate for most applications. In order to avoid reflections at the fiber end, the fiber end can also be additionally roughened. This can ensue by grinding or by additional etching.

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PATENT CLAIMS

1. Method for reducing the pump light at the exit of a fiber laser that is composed of a laser fiber and of a pump fiber surrounding it, characterized in that the pump fiber is entirely or partially stripped of its cladding over the last section preceding the light exit of the laser light or is manufactured such that the last section of the pump fiber is not clad or is only partially clad.

2. Method according to claim 1, characterized in that the cladding is removed such that the diameter of the cladding tapers wedge-like toward the end of the fiber.

3. Method according to claim 1 or 2, characterized in that a region of the fiber is completely stripped of the cladding toward the end of the fiber.

4. Method according to one of the claims 1 through 3, characterized in that the cladding of the fiber is removed by etching.

5. Arrangement for reducing the pump light at the exit of a fiber laser that is composed of a laser fiber and a pump fiber surrounding it, characterized in that the last section of the pump fiber is not clad or is only partially clad.

6. Arrangement according to claim 5, characterized in that the diameter of the cladding tapers wedge-like toward the end of the fiber.

7. Arrangement according to claim 6, characterized in that a region of the fiber is completely stripped of the cladding toward the end of the fiber.

8. Arrangement according to one of the claims 1 through 7, characterized in that the fiber end stripped of the cladding is roughened.

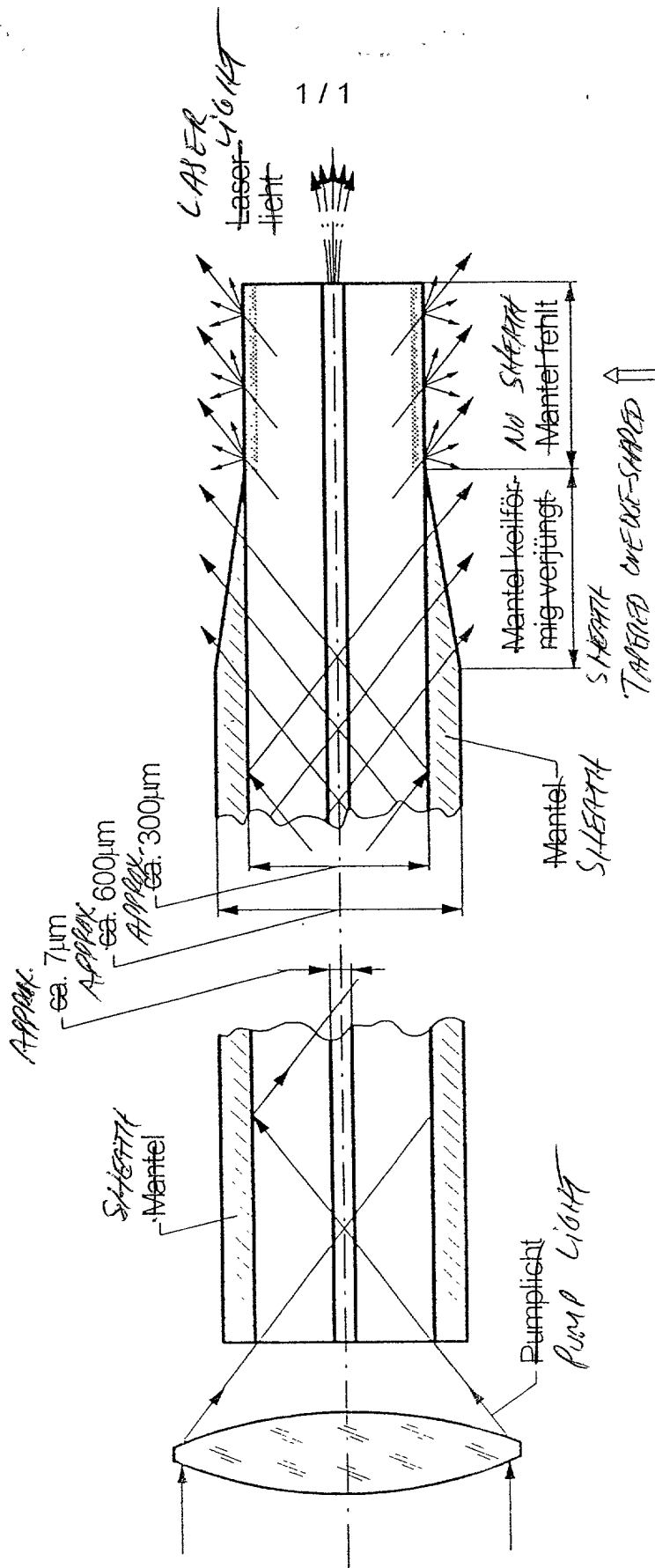
ABSTRACT

The pump fiber is stripped of its cladding over the last section. This can occur by etching the coating off. The cladding is preferably etched off wedge-shaped. As a result thereof, the remaining pump power is eliminated into the environment. How much vagrant pump light still proceeds via the fiber core to the fiber exit can be monitored over a length of the fiber completely stripped of the protective cladding.

5

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keine Wellenleiter-
funktion mehr
NO MORE WAVEGUIDE
FUNCTION

Figure
FIGURE

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY(Includes Reference to PCT International Applications) **PCT/DE98/01449**ATTORNEY'S
DOCKET NUMBER
P99,2405

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and
joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent
is sought on the invention entitled:

"METHOD AND ARRANGEMENT FOR REDUCING THE PUMP LIGHT AT THE EXIT OF A FIBER LASER"

the specification of which (check only one item below):

- ☐ is attached hereto.
- ☐ was filed as United States application
Serial No. _____
on _____,
and was amended
on _____ (if applicable).
- ☒ was filed as PCT international application
Number **PCT/DE98/01449**
on **27 May 1998**,
and was amended under PCT Article 19
on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification,
including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in
accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s)
for patent or inventor's certificate or of any PCT international application(s) designating at least one country
other than the United States of America listed below and have also identified below any foreign
application(s) for patent or inventor's certificate or any PCT international application(s) designating at least
one country other than the United States of America filed by me on the same subject matter having a filing
date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

| COUNTRY (if PCT indicate "PCT") | APPLICATION NUMBER | DATE OF FILING (day, month, year) | PRIORITY CLAIMED UNDER 35 USC 119 |
|------------------------------------|---------------------|--------------------------------------|---|
| GERMANY | 197 23 267.1 | 03 June 1997 | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |

Combined Declaration For Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications) **PCT/DE98/01449**

ATTORNEY'S DOCKET NO.
P99,2405

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

| U.S. APPLICATIONS | | | STATUS (Check one) | | |
|---------------------------------------|------------------|---------------------------------------|--------------------|---------|-----------|
| U.S. APPLICATION NUMBER | U.S. FILING DATE | | PATENTED | PENDING | ABANDONED |
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| PCT APPLICATIONS DESIGNATING THE U.S. | | | | | |
| PCT APPLICATION NO | PCT FILING DATE | U.S. SERIAL NUMBERS ASSIGNED (if any) | | | |
| | | | | | |
| | | | | | |
| | | | | | |

POWER OF ATTORNEY: As a named inventor, And I hereby appoint Messrs. John D. Simpson (Registration No. 19,842), Dennis A. Gross (24,410), Robert M. Barrett (30,142), Steven H. Noll (28,982), Kevin W. Guynn (29,927), Robert M. Ward (26,517), Brett A. Valiquet (27,841), Edward A. Lehman (22,312), David R. Metzger (32,919), Todd S. Parkhurst (26,494), James D. Hobart (24,149), Melvin A. Robinson (31,870), John R. Garrett (27,888), Joseph P. Reagen (35,332), Michael R. Hull (35,902), Michael S. Leonard (37,557), William E. Vaughan (39,056), and Lewis T. Steadman (17,074), all members of the firm of Hill & Simpson, A Professional Corporation

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312/876-0200
Ext. **3844**

| | | | | |
|-----|-------------------------|----------------------------|--------------------------|--------------------------|
| 201 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| | <u>He</u> | <u>Jürgensen</u> | <u>Heinrich</u> | |
| | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| | | <u>Raisdorf</u> | <u>GERMANY</u> | <u>GERMANY</u> |
| | POST OFFICE ADDRESS | POST OFFICE ADDRESS | CITY | STATE & ZIP CODE/COUNTRY |
| | | <u>Dutschfeldredder 22</u> | <u>24223 Raisdorf</u> | <u>GERMANY</u> |
| 202 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
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| | | | | |
| | POST OFFICE ADDRESS | POST OFFICE ADDRESS | CITY | STATE & ZIP CODE/COUNTRY |
| | | | | |
| 203 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| | | | | |
| | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| | | | | |
| | POST OFFICE ADDRESS | POST OFFICE ADDRESS | CITY | STATE & ZIP CODE/COUNTRY |
| | | | | |

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201

SIGNATURE OF INVENTOR 202

SIGNATURE OF INVENTOR 203

DATE DEC. 09, 1999

DATE

DATE